

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

**WHAT IS CLAIMED IS:**

1. A mandrel (12) for expanding flexible rubber boots (50) such as cv boots, bellows and seals for easy mounting over and removal from mechanical joints comprising a base section (18) having a perimeter with an opening therein and a plurality of spokes (14), each spoke being movably arranged with respect of the base section (18) to move from a first converged angle to a second open angle, and from a second open angle to a converged first angle, opening and closing the mandrel (12) respectively, characterized in that,

the base section (18) comprises a crenellated rim (19) with slots (23) between adjacent crenellations,

the plurality of spokes (14) are pivotally mounted in the slots (23) between adjacent crenellations of the rim (19) by pins (21) whereby the spokes (14) can only pivot radially from a closed cone shaped position to an open expanded essentially cylindrical position with respect of the base section (18), and vice versa, and comprising,

a closing device (20) (34) (120) exerting tension on the spokes to maintain the mandrel normally in a closed position and whereby when the mandrel is opened by a drive mechanism in contact with the spokes, the device will urge the mandrel to close as the drive mechanism is retracted from the spokes.

2. A mandrel as in claim 1, wherein the base section (18) is annular.

3. A mandrel as in claim 1, for easy mounting of rubber boots bellows and seals over mechanical joints of an automobile without dismantling the joints.

4. A mandrel as in claim 1, wherein the closing devise exerts tension on the spokes near their pivot points.

5. A mandrel as in claim 1, wherein the closing device is a rubber guard element (20) covering at least a portion of the spokes (14) and the rim (19) thereby also protecting the pivot joints.

6. A mandrel as in claim 1, wherein the closing device is a plurality of springs (34).

7. A mandrel as in claim 1 wherein the closing devise is a rubber boot.

5 8. A mandrel as in claim 1, comprising between 3 and 12 spokes, equally or not equally spaced apart.

9. A mandrel as in claim 1, wherein the spokes (14) are detachable from the rim (19).

10 10. A tool (10) for expanding flexible rubber boots such as cv boots, bellows and seals for easy mounting over and removing from mechanical joints in automobiles, comprising a mandrel (12) as in claim 1, and including a drive mechanism for contacting the spokes (26) to open the mandrel, said drive mechanism reciprocating between a forward position and a  
15 backward position, whereby when the drive mechanism reciprocates in one direction it causes the spokes (14) to pivot from a first converged angle to a second open angle, and when the mechanism reciprocates in the opposite direction it allows the mandrel to close to its normal position.

20 11. A tool as in claim 10, wherein the drive mechanism comprises a piston (26) provided with a connector (38) for connecting to a fluid pressure source for driving the piston (26).

25 12. A tool as in claim 11, wherein the connector (38) is a quick fit connector for coupling to a hydraulic or pneumatic source a hydraulic or pneumatic source.

13. A tool as in claim 11, further comprising a fluid flow regulator (70) attachable to the connector (38) and to a compressor.

14. A method for expanding elastic sleeves such as cv boots or bellows and mounting same over mechanical joints of automobiles without dismantling the joints, comprising the following steps:

I. providing a tool comprising:

a) a mandrel (12), comprising:

- 1) a base section (18) having a crenellated rim (19) with slots (23) between adjacent crenellations,
- 2) a plurality of spokes (14) pivotally mounted in slots (23) between adjacent crenellations of the rim (19) by pins (21), whereby the spokes (14) can only pivot radially from a closed cone shaped position to an open expanded essentially cylindrical position, with respect of the base section (18), and vice versa, and
- 3) closing device (20) (34) (120) exerting tension on the spokes to maintain the mandrel normally in a closed position, and

b) drive mechanism for driving a piston (26) in contact with the spokes to reciprocate between a forward position and a backward position for opening the mandrel and causing the spokes (14) to move from a first converged angle to a second open angle,

II. sliding an elastic sleeve element such as a cv boot or bellows (50) over the plurality of spokes (14) of the mandrel when the spokes (14) are in a closed position;

III. extending the piston of the drive apparatus (26) to urge the spokes (14) to pivotally diverge radially outward, thereby expanding the elastic sleeve (50) and providing an enlarged inner sleeve cavity;

IV. placing the mandrel (12) with the diverged spokes (14) supporting the expanded elastic sleeve (50) over a mechanical joint, so that the mechanical joint lies within the enlarged inner cavity; and

V. retracting the piston (26) whereby the closing device urges the spokes (14) to converge, allowing the elastic sleeve (50) to contract over and around the mechanical joint, and withdrawing the mandrel (12), leaving the mechanical joint enveloped by the sleeve (50).

15. A method as in claim 14, wherein said drive mechanism is a pneumatically or a hydraulically driven piston.

16. A method as in claim 14, wherein the closing device is selected from the group consisting of a rubber guard element covering the base ends of the spokes and the rim and a plurality of springs.

5